



GREENBLUM & BERNSTEIN, P.L.C.
Intellectual Property Causes
1950 Roland Clarke Place
Reston, VA 20191
(703) 716-1191

RECEIVED

NOV 10 2003

TC 1700

Attorney Docket No. P21273

In re application of : Kenji ABIKO

Serial No. : 09/926,600

Group Art Unit : 1742

Filed : November 26, 2001

Examiner : WILKING

For : Cr-BASED ALLOY HAVING AN EXCELLENT STRENGTH-DUCTILITY BALANCE
AT HIGH TEMPERATURES

COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450

Sir:

Transmitted herewith is an Appeal Brief under 37 C.F.R. § 1.192 (in triplicate) in the above-captioned application.

- ☐ Small Entity Status of this application under 37 C.F.R. 1.9 and 1.27 has been established by a previously filed statement.
- ☐ A verified statement to establish small entity status under 37 C.F.R. 1.9 and 1.27 is enclosed.
- ☐ An Information Disclosure Statement, PTO Form 1449, and references cited.
- ☐ No additional fee is required.

The fee has been calculated as shown below:

Claims After Amendment	No. Claims Previously Paid For	Present Extra	Small Entity		Other Than A Small Entity	
			Rate	Fee	Rate	Fee
Total Claims: 9	*20	0	x 9=	\$	x 18=	\$ 0.00
Indep. Claims: 2	**3	0	x 43=	\$	x 86=	\$ 0.00
Multiple Dependent Claims Presented			+145=	\$	+290=	\$ 0.00
Appeal Brief Filing Fee				\$		\$330.00
Total:				\$	Total:	\$330.00

*If less than 20, write 20

**If less than 3, write 3

☐ Please charge my Deposit Account No. 19-0089 in the amount of \$_____.☒ A Check in the amount of \$330.00 to cover the filing fee is included.☒ The U.S. Patent and Trademark Office is hereby authorized to charge payment of the following fees associated with this communication or credit any overpayment to Deposit Account No. 19-0089.☒ Any additional filing fees required under 37 C.F.R. 1.16.☒ Any patent application processing fees under 37 C.F.R. 1.17, including any required extension of time fees in any concurrent or future reply requiring a petition for extension of time for its timely submission (37 CFR 1.136)(a)(3).

Bruce H. Bernstein
Bruce H. Bernstein
Reg. No. 29,027

36,096



RECEIVED

NOV 10 2003

TC 1700

P21273.A07

Application No. 09/926,600

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant :Kenji ABIKO

Group Art Unit: AU 1742

Appl. No. : 09/926,600

Examiner: Wilkins

Filed : November 26, 2001

For :Cr-BASED ALLOY HAVING AN EXCELLENT STRENGTH-
DUCTILITY BALANCE AT HIGH TEMPERATURES

APPEAL BRIEF UNDER 37 C.F.R. § 1.192

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This Appeal is from the Examiner's Final Rejection of claims 1-6 as set forth in the Final Office Action mailed on June 4, 2003 and modified by the Advisory Action of August 18, 2003. A Notice of Appeal in response to the Final Rejection was filed on September 4, 2003. The requisite fee under 37 C.F.R. § 1.17(C) in the amount of \$330.00 is being paid by check, submitted herewith.

Inasmuch as the two-month period for filing the Appeal Brief ends on November 4, 2003, this Appeal Brief is being filed in a timely manner and no extension of time is required. However, the Commissioner is hereby authorized to charge any necessary fees, such as any necessary extension of time fees to Deposit Account No. 19-0089.

This Appeal Brief is being submitted in triplicate.

I. REAL PARTY IN INTEREST

The real party in interest is Japan Science and Technology Corporation, Japan, by an assignment which was recorded on November 26, 2001, at Reel/Frame 012413/0426.

II. RELATED APPEALS AND INTERFERENCES

Appellant is not aware of any other appeals or interferences which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

III. STATUS OF CLAIMS

Claims 1-9 are currently pending in this application. Claims 1-2 are independent claims. Claims 7-9 are withdrawn from consideration. The Advisory Action of record indicates that claims 1-6 remain rejected, for purposes of appeal.

The claims under appeal, i.e., claims 1-6, are reproduced in the Appendix attached hereto.

IV. STATUS OF AMENDMENTS

Subsequent to the Final Rejection, a Response Under 37 C.F.R. §1.116 was filed on August 4, 2003. However, the Advisory Action indicated that the Response of August 4, 2003 is not deemed to place the application in condition for allowance.

V. SUMMARY OF INVENTION

The present invention is directed to novel metallic materials having high strength and ductility at higher temperatures, and in particularly preferred embodiments, high temperatures of not lower than 1000°C. In particular, this invention is directed to a novel Cr-based alloy having high temperature strength and ductility at higher temperatures by controlling contents of C+N, S and O in the alloy and an amount of an oxide.

In this regard, Appellant notes that independent claim 1 recites a Cr-based alloy having an excellent strength-ductility balance at higher temperatures, comprising Cr: exceeding 60 mass%, C+N: not more than 20 mass ppm, S: not more than 20 mass ppm, O: not more than 100 mass ppm, O as an oxide: not more than 50 mass ppm, and the remainder being Fe and inevitable impurities. Appellant also notes that independent claim 2 recites a Cr-based alloy having an excellent strength-ductility balance at higher temperatures, comprising Cr: not less than 65 mass%, C+N: not more than 20 mass ppm, S: not more than 20 mass ppm, O: not more than 100 mass ppm, O as an oxide: not more than 50 mass ppm, and the remainder being Fe and inevitable impurities.

Turning now to the dependent claims, Appellant notes that claim 3 recites a Cr-based alloy according to claim 1, having a strength-ductility balance of $RA \times TS \geq 10000$ (%• MPa) at higher than 1000°C.

Claim 4 recites a Cr-based alloy described in claim 1, having strength-ductility balance of $RA \times TS \geq 10000$ (%• MPa) at $1050^{\circ}\text{C} \sim 1200^{\circ}\text{C}$.

Claim 5 recites a Cr-based alloy according to claim 2, having a strength-ductility balance of $RA \times TS \geq 10000$ (%• MPa) at higher than 1000°C .

Claim 6 recites a Cr-based alloy described in claim 2, having strength-ductility balance of $RA \times TS \geq 10000$ (%• MPa) at $1050^{\circ}\text{C} \sim 1200^{\circ}\text{C}$.

VI. ISSUES

A. Whether a *Prima Facie* Case of Obviousness Has Been Established.

The broad issues for consideration are whether the claims are properly rejected under 35 U.S.C. §103(a) as being unpatentable over 1) EP 597,129 (“FUJISAWA”) and 2) JP 07-278718 (“SHIDA”) in view of JP 08-225899 (“ABIKO”). Thus, the questions to be addressed are whether these documents, alone or in combination, are sufficient to establish a *prima facie* case of obviousness with respect to the Appellant’s claims.

B. Whether the Combination of SHIDA and ABIKO Is Proper.

In order to properly combine two documents, there must be some suggestion or motivation for the combination. Thus, another issue is whether such a suggestion or motivation is present.

VII. GROUPING OF CLAIMS

For each ground of rejection included in the Examiner's Final Rejection which applies to more than one claim, the rejected claims do not stand or fall together for the reasons given below.

VIII. ARGUMENT

The Examiner's June 4, 2003 Final Office Action and August 18, 2003 Advisory Action are the subject of this appeal.

A. Summary of Rejections Under 35 U.S.C. § 103(a)

Claims 1, 3, and 4 are rejected under 35 U.S.C. §103(a) as being unpatentable over FUJISAWA. The Examiner asserts that FUJISAWA teaches substantially all the recitations of the claimed invention except that it does not disclose "Cr exceeding 60 wt%." Instead, FUJISAWA teaches an alloy with Cr up to 60%. The Examiner insists, however, that the claimed amount of Cr would have been obvious because FUJISAWA's "up to 60 wt%" is close enough to the claimed "exceeding 60 wt%" to render the claimed range obvious.

Claims 1-6 are rejected under 35 U.S.C. §103(a) as being unpatentable over SHIDA in view of ABIKO. The Examiner alleges that SHIDA teaches an alloy with at least 70% Cr with reduced N and O impurities. However, the Examiner admits that SHIDA does not disclose C+N to be less than 20 ppm, S to be less than 20 ppm, O to be less than 100 ppm, and O as oxides to be less than 50 ppm. The Examiner then cites a

secondary document, ABIKO, and alleges that ABIKO teaches a method of making an alloy that produces low amounts of impurities and has examples of alloy with C, N, S, and O in total amounts of 9.1 ppm, 15.0 ppm and 18.5 ppm. The Examiner concludes that it would have been obvious to apply ABIKO's amounts in SHIDA's alloy because the reduced Cgi (defined as total quantity of C, N, S, and O) improves the workability of the alloy.

B. The Rejections Fail to Establish a Prima Facie Case of Obviousness

In response, Appellant notes that independent claim 1 recites a Cr-based alloy having an excellent strength-ductility balance at higher temperatures, comprising Cr: exceeding 60 mass%, C+N: not more than 20 mass ppm, S: not more than 20 mass ppm, O: not more than 100 mass ppm, O as an oxide: not more than 50 mass ppm, and the remainder being Fe and inevitable impurities. Appellant also notes that independent claim 2 recites a Cr-based alloy having an excellent strength-ductility balance at higher temperatures, comprising Cr: not less than 65 mass%, C+N: not more than 20 mass ppm, S: not more than 20 mass ppm, O: not more than 100 mass ppm, O as an oxide: not more than 50 mass ppm, and the remainder being Fe and inevitable impurities.

1. FUJISAWA Teaches Away from Claims 1, 3 and 4.

With respect to the rejection of claims 1, 3, 4 as being obvious over FUJISAWA, Appellant submits that there is no motivation to change FUJISAWA's Cr content to exceed 60 wt% in FUJISAWA. In fact, if anything, FUJISAWA's invention clearly and

expressly teaches away from a composition “exceeding 60 wt.%. ” On page 16, line 1, FUJISAWA states that “addition of the Cr in excess of 60% by weight is undesirable in view of an increased cost.” (Emphasis added.) Also, FUJISAWA states that “Cr content in excess of 60% by weight will result in an insufficient workability even when the content of C, N, O, P and S is reduced.” (Page 10, lines 45-48, emphasis added.) FUJISAWA further states that “the alloy having the Cr content within such a range (5-60%) would exhibit a sufficient acid resistance. Addition of an excessive amount of the Cr would result in poor workability. In addition, such an excessive addition of the Cr would not contribute to further improvement in the acid resistance.” (Page 11, lines 21-24, emphasis added) Similar statements with regard to “sufficient oxidation resistance” are also present on page 12, lines 26-30.

For this reason alone, the rejection of claims 1, 3 and 4 as being obvious over FUJISAWA should be reversed. FUJISAWA clearly teaches away from the claimed invention. Teaching away from the invention is the antithesis of obviousness. In general, “a reference will teach away if it suggests that the line of development flowing from the reference's disclosure is unlikely to be productive of the result sought by the applicant.” Baxter International, Inc. et al. v. McGaw, Inc., 47 USPQ2d 1225, 1230 (Fed. Cir. 1998). A prior art reference may be considered to teach away when “a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that

was taken by the applicant.” Monarch Knitting Machinery Corp. et al. v. Sulzer Morat GmbH et al., 45 USPQ2d 1977, 1984 (Fed. Cir. 1998); In re Gurley, 27 F.3d 551, 553, 31 USPQ2d 1130, 1131 (Fed. Cir. 1994).

On the contrary, the presently claimed invention has a much higher Cr content than FUJISAWA and provides an alloy with an excellent strength-ductility balance at higher temperatures. This is clearly and unambiguously demonstrated by experimental data of record. In Table 2 of the present specification, when Cr exceeds 60 wt.%, there are substantial increases in the alloy’s TS and RAXTS values, especially at higher temperatures. In FUJISAWA, however, excellent workability and strength at high-temperature is achieved by having Cr at 3 to 60% by weight and no more than 100 ppm in total content of C, N, O, P and S and only with at least one other element selected from Ti, Nb, Zr, V, Ta, W and B (page 5, lines 35-36).

Therefore, one of ordinary skill in the art would not be motivated to arrive at a Cr level of “exceeding 60 wt%” using FUJISAWA’s alloy (in view of this fact and in view of the express guidance to avoid exceeding 60 wt.% of Cr) and the rejection based on FUJISAWA is improper. Accordingly, the rejection of claims 1, 3 and 4 as obvious over FUJISAWA should be reversed.

2. FUJISAWA’s High Temperature Is Not At A Super-high Temperature Of The Present Invention

Another difference between FUJISAWA and the present invention is that the

high temperature strength in FUJISAWA's invention merely means, as described on page 15, line 52 of its specification, strength at a temperature of 900°C, but not high temperature strength at a super-high temperature of more than 1000°C as applied in the present invention.

FUJISAWA teaches a product with 3-60 wt % of Cr. It achieves higher strength at a temperature of 900°C by adding at least one alloy element selected from Ti, Nb, Zr, V, Ta, W and B.

3. The Proposed Combination Of SHIDA And ABIKO Is Impermissible

With respect to the rejection of claims 1-6 over SHIDA in view of ABIKO, Appellant submits that the combination of these two documents is improper.

Regarding SHIDA, as the Examiner correctly recognizes, SHIDA teaches an alloy that contains more than 60% by weight of Cr. But the other elements of the alloy are more than an order of magnitude higher than what are claimed in the present invention. For instance, SHIDA's alloy could contain more than 1000 ppm of N and more than 900 ppm of O. On the contrary, the present claims require C+N of not more than 20 ppm. (In this regard, Appellant notes that SHIDA's alloy is not even close, and Appellant expressly reserves the right to a scope of equivalents which extends to values close to those claimed.) The difference is due to the different purposes of the two products. While SHIDA teaches an alloy to be cast into a product, the present invention

provides an alloy which can be plastically worked after casting and made into a product. Moreover, there is no disclosure or suggestion that excellent strength at a high temperature is achieved by decreasing C, N, S, and O to an extremely small amount as compared to the amounts used in the alloy of SHIDA.

Regarding ABIKO, it teaches the use of smaller amounts of C, N, S, and O and a Cr amount of less than 60%. Its alloy has excellent plastic deformability in a temperature range of recrystallization temperature or below. However, ABIKO again expressly teaches away the use of Cr to more than 60%. In Paragraph 0018¹, ABIKO states that "the effect is saturated and becomes disadvantageous economically, even if it adds exceeding 60 wt %, although it is necessary to add 15 wt% Cr at least in order to maintain the oxidation resistance as high temperature material." Thus ABIKO is completely deficient in establishing the obviousness of the present invention.

Moreover, in order to combine two prior documents to reach all recitations of the claimed invention, there must be some suggestion or motivation for such combination. This is particularly important in this application since an alloy, by its definition, is a combination of various elements. As the Federal Circuit stated:

"Virtually all inventions are combinations of old elements. Therefore, an examiner may often find every element of a claimed invention in the prior art. If identification of each claimed element in the prior art were sufficient to negate patentability, very few

¹ This and the following quotations of ABIKO are based on information supplied to the undersigned by way of what are believed to be translations of the Japanese language ABIKO document.

patents would ever issue. Furthermore, rejecting patents solely by finding prior art corollaries for the claimed elements would permit an examiner to use the claimed invention itself as a blueprint for piecing together elements in the prior art to defeat the patentability of the claimed invention.” *In re Rouffet*, 47 USPQ2d 1453, 1457 (Fed Cir 1998).

In this application, Appellant submits that one of ordinary skill in the art would not be motivated to either 1) reduce the amounts of C, N, S, and O in SHIDA to levels of in ABIKO’s product because reducing in such a large amount would produce a product completely different from the teachings of SHIDA, and 2) increase the amount of Cr in ABIKO to levels of SHIDA because ABIKO expressly teaches away from such increase. Therefore, the combination of the two documents is improper and the rejection based on this combination is also improper and should be reversed.

When a rejection depends on a combination of prior art references, the PTO must show that there is some teaching, suggestion, or motivation to combine the references.

In re Fine, 837 F.2d 1071, 1074, 5 USPQ2d 1596, 1598 (Fed. Cir. 1988). In other words, to “establish a prima facie case of obviousness, [the challenger to patentability] must show ‘some objective teaching in the prior art or that knowledge generally available to one of ordinary skill in the art would lead that individual to combine the relevant teachings of the references.’” Tec Air, Inc. v. Denso Manufacturing Michigan Inc., 52 USPQ2d 1294, 1298 (Fed. Cir. 1999) (quoting Fine, 837 F.2d at 1074, 5

USPQ2d at 1598). “There is no suggestion to combine, however, if a reference teaches away from its combination with another source.” Id.

Accordingly, the rejection based on SHIDA and ABIKO should be reversed.

4. The Inventions Of SHIDA And ABIKO Are Fundamentally Different From The Invention Of The Present Invention.

Furthermore, with respect to SHIDA and ABIKO, Appellant respectfully points out the following:

SHIDA’s invention relates to a product which does not require workability after casting; therefore, there is no necessity of either high purification by decreasing C + N, S and O as gas components in alloy to ultra-micro amount or improvement of workability. In its Example, N is not less than 1185 ppm and O is 956 ppm, which contents are quite different from those of the present invention and far different from high purification. Therefore, there is no desirability of combining SHIDA’s invention with ABIKO’s invention.

The Examiner states that the present invention does not claim any processed product. However, the present claims recite “A Cr-based alloy having an excellent strength-ductility balance at high temperature,” Therefore, workability is clearly required. Further, the Examiner states that SHIDA’s invention defines that N and O are not more than 2000 ppm and includes claims of the present invention. However, SHIDA’s invention does not disclose or suggest that C+N should be not more than 20

P21273.A07

mass ppm and O not more than 100 mass ppm and the necessity of decreasing the respective values to at least these levels, and these contents disclosed in Example are greater amounts as described above.

Moreover, ABIKO's invention discloses a technique of decreasing C+N, S and O as gas components to ultra-micro amount. However, ABIKO discloses metal having excellent deformability at a temperature of not more than recrystallization temperature (not more than 900°C according to the specification), but does not disclose the Fe-Cr alloy having excellent workability and strength-ductility balance at super-high temperature of not less than 1000°C that is the subject of the present invention.

Further, ABIKO limits the range of Cr to not more than 60 wt%, and describes in an Example of up to 50 wt%. Regarding this, the Examiner states that the reasons why Cr is limited to 60 wt% in ABIKO are merely economic. However, ABIKO describes in paragraph 0018 that "because the effect is saturated and becomes disadvantageous economically, even if it adds exceeding 60wt%" ABIKO thus states that the addition of not less than 60 wt. % Cr does not result in improvement of characteristics, i.e., the addition of Cr in excess of 60 wt% is economically disadvantageous. Therefore, ABIKO limits Cr to not more than 60 wt% viewed from characteristics.

Further, ABIKO also describes in paragraph 0018 of its specification that "in order to increase strength at a high temperature, it is extremely effective to add substitutional solid-solute reinforced elements such as Mo, W, Nb, Ta and Zr." The

description shows that improvement of high temperature strength is conducted not by adding not less than 60wt% of Cr but adding substitutional solid-solute reinforced elements. Therefore, ABIKO's invention and the present invention for aiming at improvement of high temperature strength by adding Cr in excess of 60 wt.% are fundamentally different from each other in technical respects.

As explained above, ABIKO's invention does not disclose nor suggests but simply denies addition of Cr in excess of 60 mass %. Further, the subject of ABIKO's invention lies in improvement of workability at not more than 900°C, and does not aim to improve workability at a super-high temperature of not less than 1000°C.

Therefore, even if ABIKO's invention which does not have any technical idea of adding Cr in excess of 60 mass% and any subject recognition of improving workability at super-high temperature of not less than 1000°C is combined with SHIDA which does not require any necessity of improving workability, it is impossible to conceive the present invention by those skilled in the art.

5. The Rejections of Record Are Impermissibly Based On Hindsight

The rejections of record can only succeed if one employs the teachings of Appellant's specification in arriving at the invention, and in selectively adopting isolated teachings of the documents employed in the rejections, which selective adoption does not establish obviousness. Accordingly, the rejections should be reversed.

A determination of obviousness can not be based on the hindsight combination of components selectively culled from the prior art to fit the parameters of the patented invention. There must be a teaching or suggestion within the prior art, or within the general knowledge of a person of ordinary skill in the field of the invention, to look to particular sources of information, to select particular elements, and to combine them in the way they were combined by the inventor. ATD Corporation v. Lydall, Inc., 48 USPQ2d 1321, 1329 (Fed. Cir. 1998).

A determination of obviousness can not be based on the hindsight combination of components selectively culled from the prior art to fit the parameters of the patented invention. There must be a teaching or suggestion within the prior art, or within the general knowledge of a person of ordinary skill in the field of the invention, to look to particular sources of information, to select particular elements, and to combine them in the way they were combined by the inventor. ATD Corporation v. Lydall, Inc., 48 USPQ2d 1321, 1329 (Fed. Cir. 1998). In other words, “defining the problem in terms of its solution reveals improper hindsight in the selection of the prior art relevant to obviousness.” Monarch Knitting Machinery Corp. et al. v. Sulzer Morat GmbH, et al., 45 USPQ2d 1977, 1981 (Fed. Cir. 1998) (citing In re Antle, 444 F.2d 1168, 1171-72, 170 USPQ 285, 287-88 (CCPA 1971)).

As Judge Markey explained:

“To imbue one of ordinary skill in the art with knowledge of the invention in suit, when no prior art reference or references of record convey or suggest that knowledge, is to fall victim to the insidious effect of a hindsight syndrome wherein that which only the inventor taught is used against its teacher.”

W. L. Gore & Associates, Inc. v. Garlock, Inc., 220 USPQ 303, 313 (Fed. Cir. 1983).

6. The Rejected Claims Do Not All Stand Or Fall Together

Additionally, each of the dependent claims which are also the subject of this rejection is patentable over the cited documents at least because each of these dependent claims includes additional recitations.

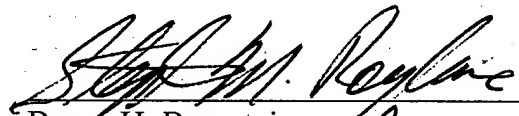
In particular, Appellant notes that dependent claims 3-6 further patentably define the invention and recite the particular properties of the alloy which are not disclosed or suggested by any of the cited documents or combination thereof. For example, the recited “strength-ductility balance of $RA \times TS \geq 10000$ (%• MPa) at higher than 1000°C ” of claim 3 is not disclosed or suggested by any of the cited documents or combination thereof.

In view of the above, Appellant respectfully requests that the rejection of these claims be reversed.

IX. CONCLUSION

For the reasons set forth above, it is respectfully submitted that the Examiner has failed to establish a prima facie case of obviousness, which is a prerequisite for maintaining a rejection under 35 U.S.C. §103(a). The Board is, therefore, respectfully requested to reverse the Final Rejection, and to allow the application to issue.

Respectfully submitted,
Kenji ABIKO


Bruce H. Bernstein
Reg. No. 29,027 *Reyno 31,292*

November 4, 2003
GREENBLUM & BERNSTEIN, P.L.C.
1941 Roland Clarke Place
Reston, VA 20191
(703) 716-1191

APPENDIX

CLAIMS

1. A Cr-based alloy having an excellent strength-ductility balance at higher temperatures, comprising Cr: exceeding 60 mass%, C+N: not more than 20 mass ppm, S: not more than 20 mass ppm, O: not more than 100 mass ppm, O as an oxide: not more than 50 mass ppm, and the remainder being Fe and inevitable impurities.
2. A Cr-based alloy having an excellent strength-ductility balance at higher temperatures, comprising Cr: not less than 65 mass%, C+N: not more than 20 mass ppm, S: not more than 20 mass ppm, O: not more than 100 mass ppm, O as an oxide: not more than 50 mass ppm, and the remainder being Fe and inevitable impurities.
3. A Cr-based alloy according to claim 1, having a strength-ductility balance of $RA \times TS \geq 10000 (\% \cdot \text{MPa})$ at higher than 1000°C .
4. A Cr-based alloy described in claim 1, having strength-ductility balance of $RA \times TS \geq 10000 (\% \cdot \text{MPa})$ at $1050^{\circ}\text{C} \sim 1200^{\circ}\text{C}$.
5. A Cr-based alloy according to claim 2, having a strength-ductility balance of $RA \times TS \geq 10000 (\% \cdot \text{MPa})$ at higher than 1000°C .
6. A Cr-based alloy described in claim 2, having strength-ductility balance of $RA \times TS \geq 10000 (\% \cdot \text{MPa})$ at $1050^{\circ}\text{C} \sim 1200^{\circ}\text{C}$.